



**Australian Government**

**Australian Transport Safety Bureau**

**ATSB TRANSPORT SAFETY INVESTIGATION REPORT**

Aviation Occurrence Report – 200603726

Final

**Pressurisation system event – Brisbane, Qld  
29 June 2006  
VH-QOD  
Bombardier DHC-8-402**





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### **Abstract**

On 29 June 2006, Bombardier DHC-8-402 (Dash 8-400) was being operated on a scheduled passenger service from Brisbane to Mackay, Qld. As the aircraft passed through FL220, the cabin altitude warning light illuminated, accompanied by the associated aural warning.

Initial checks by the crew indicated that the cabin differential pressure and cabin air flow appeared to be normal. The aircraft's bleed air switches also appeared to the crew to be correctly selected to the ON position.

An attempt by the crew to manually confirm the position of the bleed air switches revealed that both switches were in the OFF position. The subsequent selection of the switches to the ON position extinguished the cabin altitude warning light and the associated indications, and the aircraft's pressurisation system commenced normal operation.

In response to this incident, the operator developed an amendment to the Flight Crew Operating Manual for application in the company's turboprop operation, including affecting the Dash 8-400 checklist. The amendments to the aircraft checklist included:

- revised responses to the pressurisation-related checklist items
  - an additional Pressurisation checklist requirement to be conducted at Transition
  - the addition of the requirement for the tactile confirmation of some checklist responses, including when one pilot has responsibility for both the 'challenge' and 'response' actions.
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# THE AUSTRALIAN TRANSPORT SAFETY BUREAU

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The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations. Accordingly, the ATSB also conducts investigations and studies of the transport system to identify underlying factors and trends that have the potential to adversely affect safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and, where applicable, relevant international agreements. The object of a safety investigation is to determine the circumstances in order to prevent other similar events. The results of these determinations form the basis for safety action, including recommendations where necessary. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations.

It is not the object of an investigation to determine blame or liability. However, it should be recognised that an investigation report must include factual material of sufficient weight to support the analysis and findings. That material will at times contain information reflecting on the performance of individuals and organisations, and how their actions may have contributed to the outcomes of the matter under investigation. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. While the Bureau issues recommendations to regulatory authorities, industry, or other agencies in order to address safety issues, its preference is for organisations to make safety enhancements during the course of an investigation. The Bureau prefers to report positive safety action in its final reports rather than making formal recommendations. Recommendations may be issued in conjunction with ATSB reports or independently. A safety issue may lead to a number of similar recommendations, each issued to a different agency.

The ATSB does not have the resources to carry out a full cost-benefit analysis of each safety recommendation. The cost of a recommendation must be balanced against its benefits to safety, and transport safety involves the whole community. Such analysis is a matter for the body to which the recommendation is addressed (for example, the relevant regulatory authority in aviation, marine or rail in consultation with the industry).

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# FACTUAL INFORMATION

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## History of the flight

On 29 June 2006, a Bombardier DHC-8-402 (Dash 8-400), registered VH-QOD, departed Brisbane Airport, Qld on a scheduled night passenger flight to Mackay, Qld. The flight was the last in a series of three flights by the crew that day, and was scheduled to depart at 1835 Eastern Standard Time<sup>1</sup>.

The crew commenced duty in preparation for the series of flights at 1000 that morning. The flights incorporated the provision by the aircraft captain of the first day of transition training for the copilot, who had extensive experience flying earlier models of the Dash-8. In order to maximise the copilot's exposure to the Dash 8-400, the copilot had been the flying pilot for the two previous flights, and was the flying pilot for the flight to Mackay.

The captain reported that, on the flight immediately prior to the Mackay flight, the copilot had selected the aircraft's bleed flow rotary switch<sup>2</sup> to the Minimum<sup>3</sup> (MIN) position, and the bleed air<sup>4</sup> switches (figure 1) to OFF for takeoff. Those selections reflected the procedure in the earlier models of the Dash-8. During the pre take-off checks for that flight, the captain had identified the mis-selection, confirmed that the bleed flow rotary switch was selected to MIN, and re-set the bleed air switches to ON for the takeoff as required in the Dash 8-400.

**Figure 1: Overhead air conditioning panel**



- 1 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST), as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) +10 hours.
- 2 Controls the flow of engine bleed air to pressurise the aircraft's cabin.
- 3 Indicating the selection by the flight crew of the minimum flow of engine bleed air to the cabin.
- 4 Compressed air that is bled from the aircraft's engines.

The copilot stated that, during the taxi for takeoff to Mackay, the bleed air switches were again incorrectly selected to OFF. The copilot could not recall having advised the captain of the position of the bleed air or rotary flow switches. In this instance, the incorrect switch position remained unnoticed by the captain.

During the climb to the planned cruising level of flight level (FL) 240, the captain conducted the normal scans of the aircraft instrumentation, including of the indications of cabin pressurisation. The captain reported that, as the aircraft climbed through 10,000 ft above mean sea level (AMSL), the cabin pressure differential<sup>5</sup> was in the normally-expected range of about 4 to 5 psi.

As the aircraft passed FL220, the master warning panel and cabin altitude warning lights illuminated and the associated aural alert sounded. The captain reported that he immediately checked the cabin pressure differential and rotary flow and bleed air switch positions. The cabin pressure differential appeared to the captain to remain in the 4 to 5 psi range, and the rotary flow and bleed air switches appeared visually to be in the correct positions.

A physical check of the position of the switches by the captain indicated however that both bleed air switches were in the OFF position. The movement by the captain of the bleed air switches to the ON position extinguished the cabin altitude warning light, and the aircraft's pressurisation system commenced normal operation.

The captain explained the apparently normal cabin pressure differential at the time of the cabin altitude alert as possibly a combination of the ram effect due to the aircraft's high speed, and the integrity of the aircraft's as-new pressure hull. The captain expressed surprise that the flight attendants had not commented on the quality of the cabin environment or temperature.

## **Personnel information**

The captain and copilot were properly qualified to undertake the flight. The training flight was the third of a minimum of thirteen required in order for the copilot to complete the operator's transition program to the Dash 8-400. The copilot reported during interview that, although compliant with the operator's flight and duty time limitations, it had been a long and fatiguing day.

## **Bleed air system operation in the Dash-8 aircraft**

The bleed air and rotary flow switches were located on the right overhead panel (figure 1). There was about 3 mm switch movement between the OFF and ON selections. The bleed air switches did not have dedicated background or associated lighting for use during night operations, instead relying on general residual ambient lighting from the electronic flight instrumentation system screens to illuminate the switches and their ON/OFF selection. The captain reported that, in retrospect, at night it was difficult to visually confirm the position of the bleed air switches from the respective pilot's control station. That was particularly the case from the captain's control station (figure 2 – a daytime view).

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<sup>5</sup> The pressure differential between the aircraft cabin and the surrounding atmosphere.

**Figure 2: Daytime view of the right overhead panel from the captain's control station**





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## ANALYSIS

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It was probable that the combination of habit on previous Dash 8 models and the fatigue that was reported by the copilot contributed to the mis-selection of the bleed air switches on the flights to Brisbane and Mackay.

The inconsistent detection by the captain of the mis-selections of the bleed air switches by the copilot confirmed the unreliability of the visual taxi and after take-off checks of the pressurisation system controls. The difficulty experienced by the captain during those visual checks was exacerbated by the lack of dedicated background or associated lighting to illuminate the right overhead panel.

The illumination of the cabin altitude warning light presented the captain with seemingly contradictory information. The cabin pressure differential appeared to be in the correct range, and a visual inspection of the bleed air switches led the captain to believe that they were correctly selected ON. The action by the captain to manually confirm the position of the bleed air switches rectified the mis-selection of the bleed air switches, and prevented the development of a more serious incident.



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## **FINDINGS**

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### **Contributing factors**

- During the taxi for takeoff to Mackay, the copilot mis-selected the bleed air switches to OFF.
- The nature of the right overhead panel lighting and the minimal bleed air switch movement made it difficult to visually determine the position of the bleed air switches from the captain's control station. The reliance in the after take-off checklist on a visual check of the position of those switches increased the risk that any mis-selection of the switches would remain unnoticed until the activation of the cabin altitude warning light and associated warnings.



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## SAFETY ACTIONS

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### Aircraft operator

In response to this incident, the operator developed an amendment to the Flight Crew Operating Manual for application in the company's turboprop operation, including affecting the Dash 8-400 checklist. The amendments to the aircraft checklist included:

- revised responses to the pressurisation-related checklist items
- an additional Pressurisation checklist requirement to be conducted at Transition<sup>6</sup>
- the addition of the requirement for the tactile confirmation of some checklist responses, including when one pilot has responsibility for both the 'challenge' and 'response' actions.

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<sup>6</sup> Point at which the aircraft climbs through the Transition Altitude (10,000 ft above mean sea level in Australia).